As Gordon Moore’s law saying “The complexity for minimum component costs has increased at a rate of roughly a factor of two per year” is still active, even considering the fact, that it has been over 50 years since its publication, average computer processing cost keeps getting cheaper and its impact on all the sectors of human activity including economics grows stronger and stronger even though the rate of growth has considerably decreased.

It is not a surprise that more complex and diverse ways to classify and process data, opened by technology development, changed ways of study for all the social sciences: it’s easier to get a hint of the “Bigger picture” using more diverse data and we get an ability to process even more data with the growth of processing power because with them getting cheaper it’s easier to afford systems with increased computation capabilities.

Just from the Justin Wolfers and Betsey Stevenson’s 2012 work, stating that “computing power has made it extremely easy and cheap to analyse all the data you produce. An economist with a laptop can, in a matter of seconds, do the kind of number crunching it used to take a roomful of Ph.D.’s weeks to achieve. Just a few decades ago, economists used punch cards to program data analysis for their empirical studies. The result has been a boom in empirical research.” it’s possible to approximate the impact information age breakthrough cased on the field. But even before it, when the first of the computers found their usage, for reference, Daniel Suit in his work from 1962 wrote that IBM 1620 would allow us to “use models of indefinite size, limited only by the available data” and Charles Wolf and John Enns stated that computers gave us ability to create direct connection between “formal theory” and “databases”. This way, the data can be processed with limited human control which allows economists concentrate on more interesting and important matters instead of spending their time on calculations.

In contradiction to practical usages, impact automated computing systems cased to theoretical part of the science is not even comparable to their practical usefulness. Even if they have an ability to convert a theory into applied work as it did for the natural sciences, this type of impact on the economics was rather insignificant until recent years.

But let’s sate it in a clear way: What do computer offer for the economics scientists and how do they improve the way scientific process is handled? First of all, the time needed for the calculation is drastically lower comparing to all the methods that came before it (like routine calculators or even pencil plus paper). At the very list, they can be used as fast and reliable tool able to solve input-output models, estimate regression coefficients and simulate processes. It doesn’t change much in terms of theory but makes calculation time-efficiency better. But the push it gives to the research doesn’t stop there. As an example, I want to mention work on correlation published in 1949 by statisticians Donald Cochrane and Guy Orcutt amount of calculations in which would be impossible to process in a one human lifetime if it was being done using routine calculator. It shows that new possibilities and computation methods were opened before the economists even at the start of computerization process.

The next and the most important possibility integrating computer systems in scientific process opened is the amount of data being stored. According to the Relx Group’s research we can store up to 677 973 pages of text data in just 1 gigabyte of memory. It’s easy to compare size of simple flash drive (I am not even talking about hard drives) and the amount of paper it replaces.

As less important but still quite useful technique I want to mention simulations. They allow to generate new typical evidence end data based on the results of real data research in order to discover new possibilities and improve data classification systems.

Now, large databanks are available for both academic and commercial use and they have changed econometric software: various markets are now computerized and its data and price information is being processed in real time and recorded. The data set has grown big enough to not be able to be studied by traditional means. This cased new empirical tools, such as machine learning, to find their usage in economics, as well.

This way more realistic simulations are available and, as the result, theoretical models can be simpler and less accurate. It allows scientists to shift their focus from methodology of the process to its results.

In 1980s, Argonne National Laboratory, Illinois, developed and used an Automated Reasoning Assistant to prove mathematical theorems alongside human mathematicians. Recently the system was applied to the economic research and, as result it had not only proven all know theorems (e.g. Tang and Lin 2009, Kerber, Rowat and Windsteiger, 2011) but did discover new ones (e.g. Tang and Lin 2011; Geist and Endriss 2011; see also Chatterjee and Sen 2014).

# References

Backhouse, R., & Cherrier, B. (2016, May 21). 'It's Computerization, Stupid!' The Spread of Computers and the Changing Roles of Theoretical and Applied Economics. Birmingham, United Kingdom.

Cherrier, B. (2016, February 7). *9 ways computers have affected the development of economics.* Retrieved from The Undercover Historian: https://beatricecherrier.wordpress.com/2016/02/07/9-ways-computers-have-affected-the-development-of-economics/

Cherrier, B. (2016, May 19). *How the computer transformed economics. And didn’t.* Retrieved from Institute of New Economic Thinking: https://www.ineteconomics.org/perspectives/blog/how-the-computer-transformed-economics-and-didnt

Grogan, M. (2015, September 14). *Serial Correlation: Durbin-Watson and Cochrane-Orcutt Remedy.* Retrieved from Using Data Science To Implement Business Solutions: http://www.michaeljgrogan.com/serial-correlation-and-the-cochrane-orcutt-remedy/

Moore, G. (1965). Cramming more components onto integrated circuits. *Electronics*, 1-4.

Orcutt, G., & Cochrane, D. (1949). Application of Least Squares Regression to Relationships Containing Auto-Correlated Error Terms. *Journal of the American Statistical Association*, 32-61. Retrieved from Wikipedia.org.

RELX Group. (2007). How Many Pages in a Gygabyte? Dayton, Ohio.

Roth, A. E. (2002, July). The Economist as Engeneer: Game Theory. Experimentation and Calculation as Tools for Design Economics. Cambridge, Massachusetts.

Stevenson, B., & Wolfers, J. (2008, August). Economic Growth and Subjective Well-Being: Reassessing the Easterlin Paradox. Brookings, South Dakota, United States of America: Brookings Papers on Economic Activity.

The Economist. (2016, May 12). After Moore’s law. The future of computing. *The Economist*, pp. 1-2.